Sun City Technical Assistance

October 6th,
2020

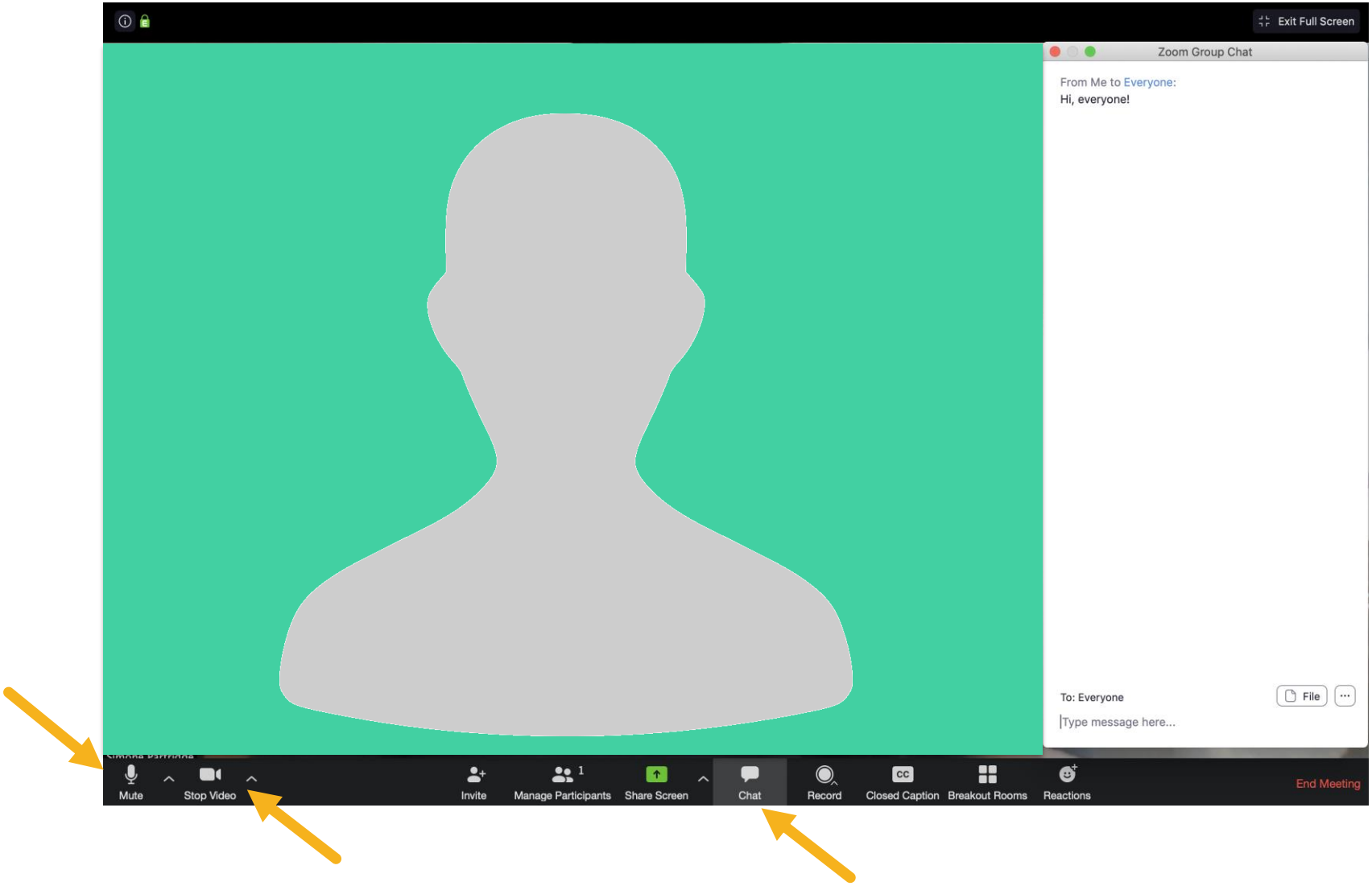
Kansas
Department of Agriculture
Division of Water Resources

Thank you for joining us today!

Your input is very important to this work.

How to use Zoom

Kansas Department of Agriculture
Division of Water Resources



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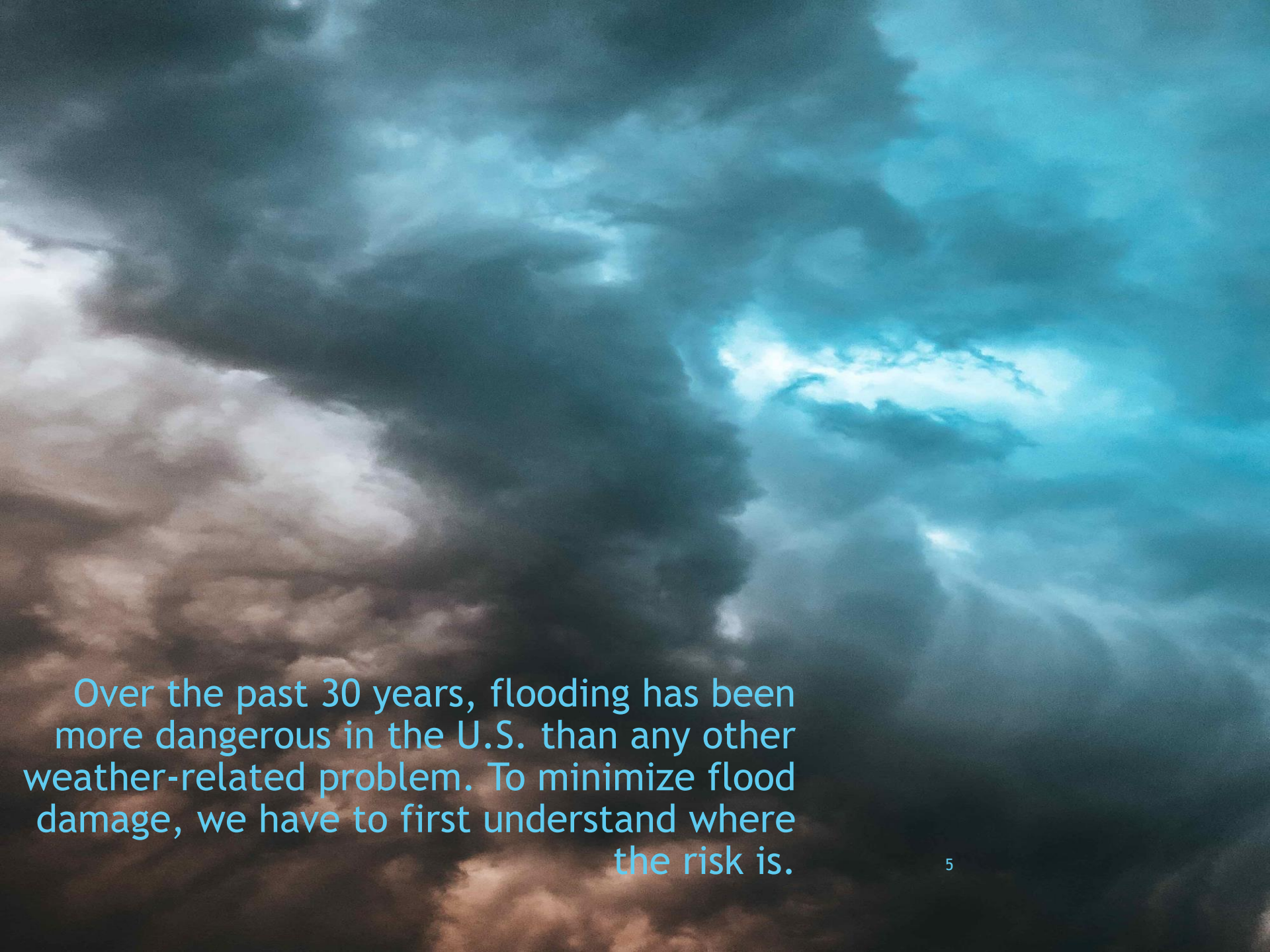
Intros



Over the past 30 years, flooding has been more dangerous in the U.S. than any other weather-related problem. To minimize flood damage, we have to first understand where the risk is.

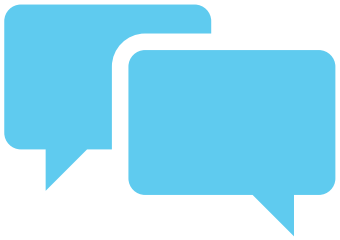
Today's Goals

- Give an overview of the scope of the Technical Assistance project
- Analyze the current flooding problem
- Discuss flood mitigation scenarios used for Analysis
- View results of 2D hydraulic analysis
- Discuss estimated construction costs and level of impact for each scenario
- **OPEN DISCUSSION**


Overview

Overview of Project Scope

- To develop a series of engineering model runs to help determine the best course of action to alleviate flooding within the city.
- Flood mitigation scenarios could include levees, culvert improvements, channelization, detention ponds
- Provide Sun City with the results of the engineering analyses and estimated design/build costs for each scenario.



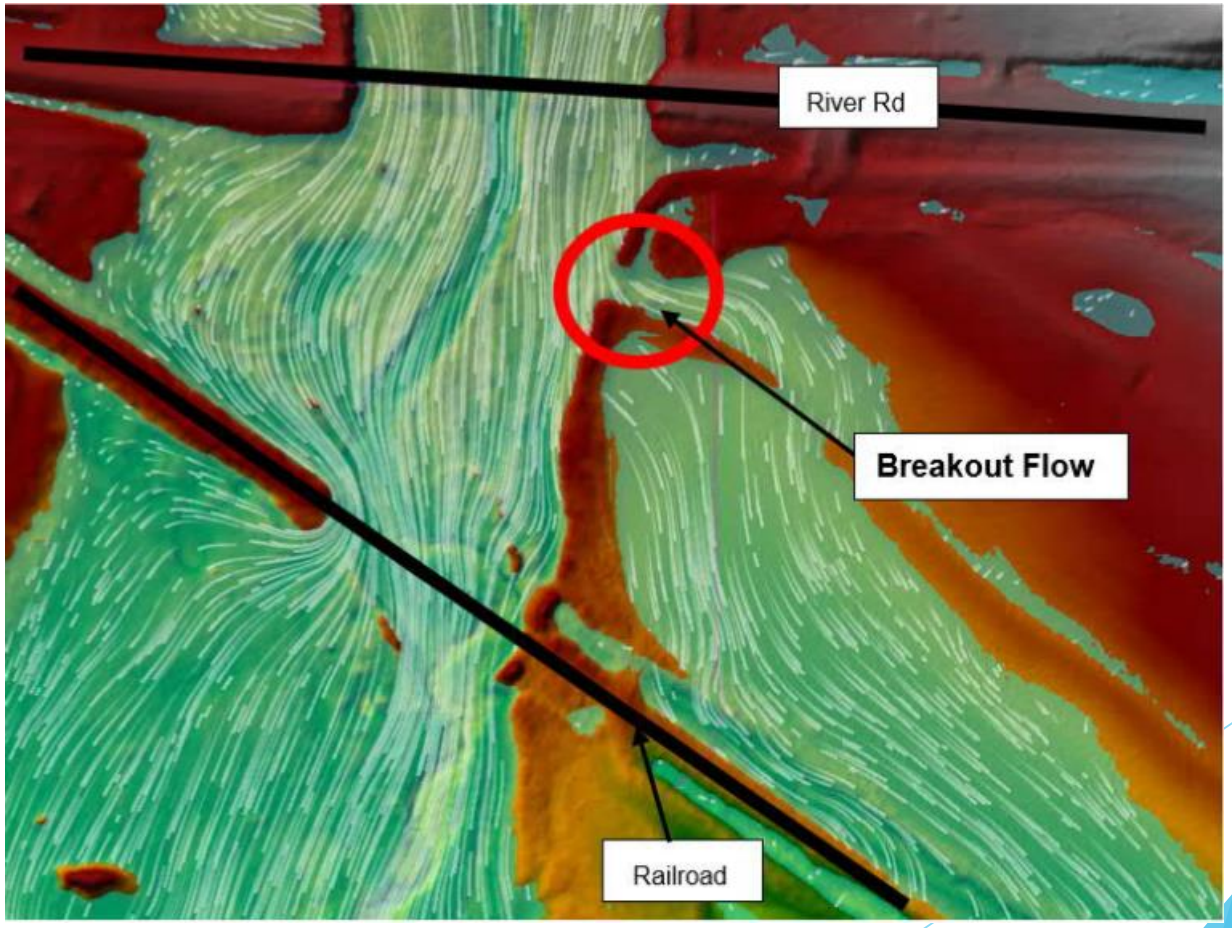
Flood Risk Discussion

Current Flood Risk

Intersection of 1st Ave W and Elm St

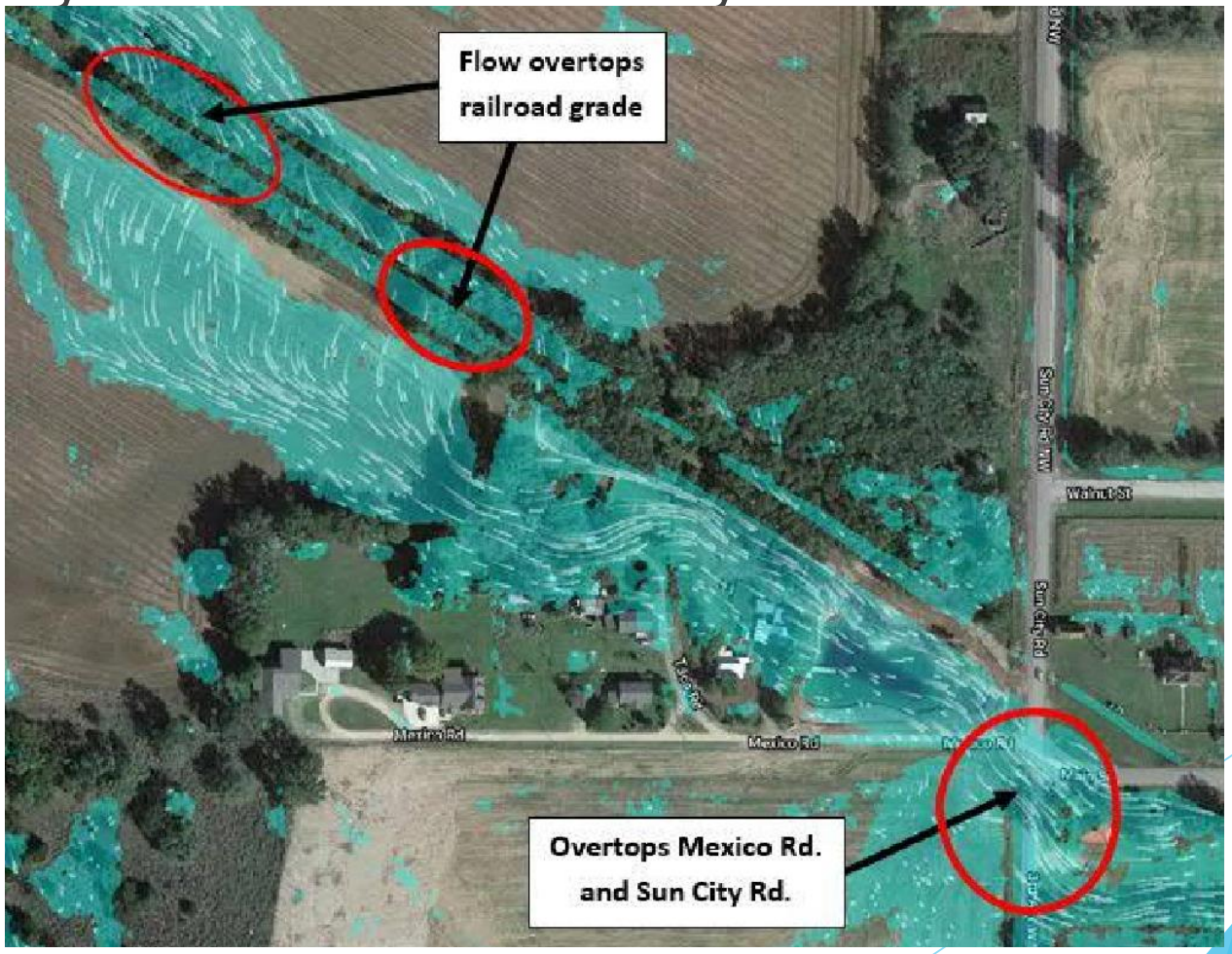
Current Flood Risk

- Overflow from Turkey Creek runs along north and south side of railroad embankment



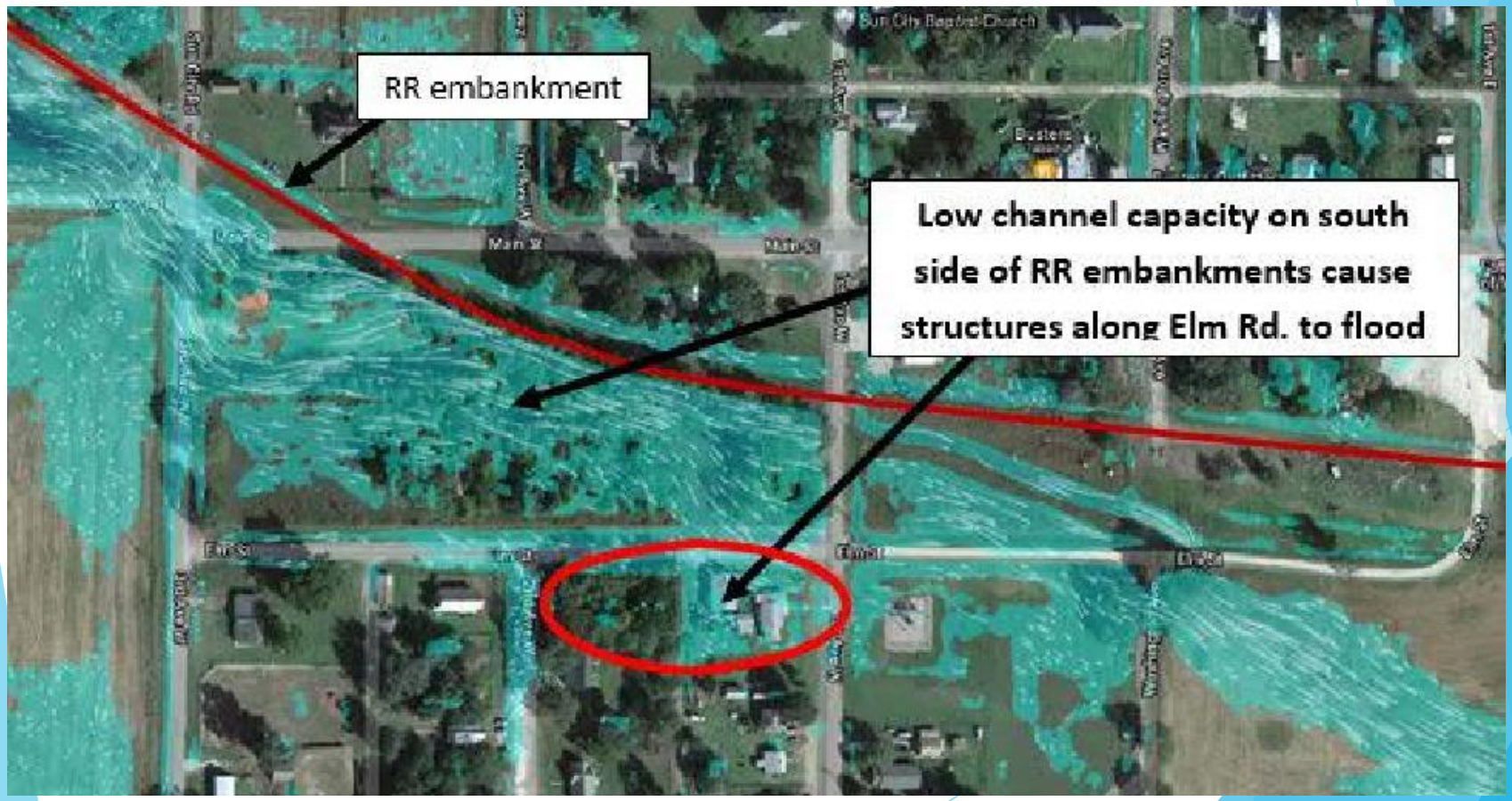
Current Flood Risk

- Flow overtops the railroad grade and crosses Sun City Rd into the community



Current Flood Risk

- Flow continues east over 1st Ave. and exits Sun City to the southeast eventually discharging into the Medicine Lodge River



Recent Storm Events

- Analysis shows 2%-4% annual exceedance probability storms experienced in Sun City since 2018

Date(s) of Storm Event	NEXRAD Storm Duration Estimate	Weighted Avg. Precipitation Total	Estimated Annual Exceedance Probability
Sept. 3, 2018	12 hours	4.79 inches	4% AEP, or 25-year Storm
Oct 8-9, 2018	50 hours	5.79 inches	Between 2% - 4% AEP, or 25-50 year Storm
May 7-8, 2019	34 hours	5.27 inches	4% AEP, or 25-year Storm

Modeled Storm Events

- 2D Models show significant breakout flow from Turkey Creek

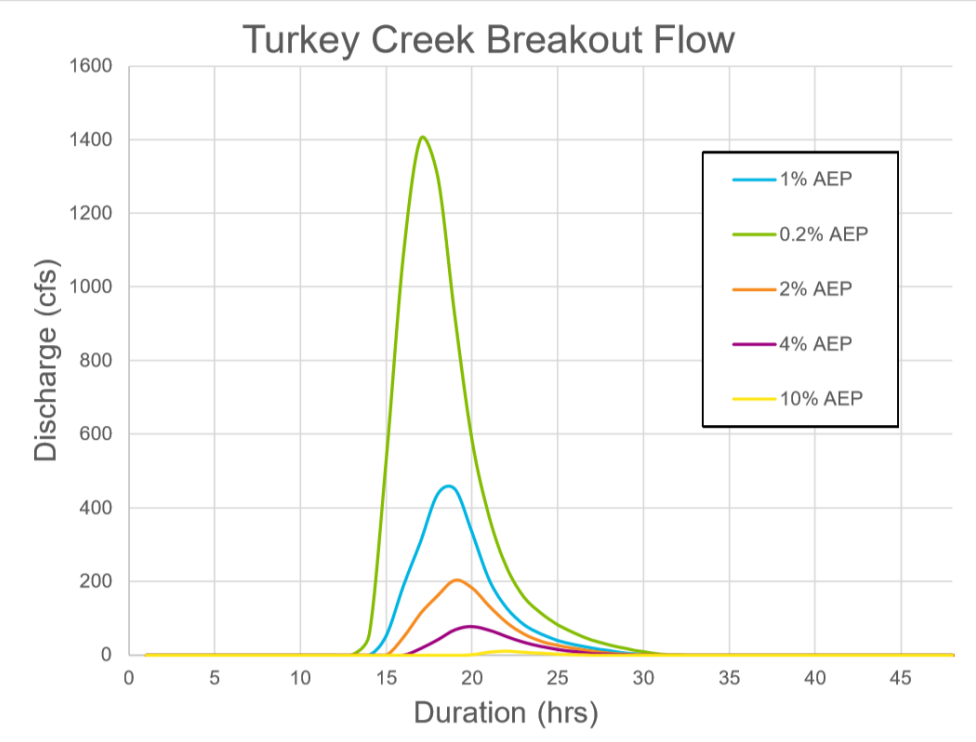
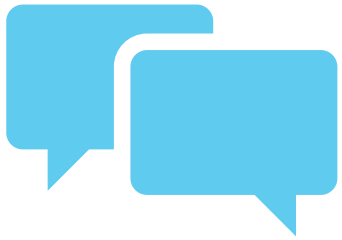


Table 4: Total Breakout Flow from Turkey Creek

Storm Event	1% AEP	0.2% AEP	2% AEP	4% AEP	10% AEP
Peak Discharge (cfs)	450.9	1403.2	203.7	78.1	10.6
Total Volume (ac-ft)	194.6	576.1	90.3	34.2	3.1



Flood Mitigation Discussion

Modeled Flood Mitigation Actions

- Improve conveyance of flood through Sun City
  - Culvert/Channel Improvements
- Detain water upstream of Sun City
  - Detention Basins
- Levee along Turkey Creek to prevent breakout flow
- Each alternative has several scenarios associated with it

Flood Prevention Scenarios (Levee)

- Proposed Levee Location

Flood Prevention Scenarios (Levee)

- Proposed Levee Scenarios and Characteristics

	Levee 1	**Levee 2**	**Levee 3**
Design Height	Elev: 1698ft NAVD88 Height: 4 to 5.5 ft	Elev: 1697ft NAVD88 Height: 3 to 4.5 ft	Elev: 1696ft NAVD88 Height: 2 to 3.5 ft
Overtopping Criteria	Not Designed to Overtop	Not Designed to Overtop	Not Designed to Overtop
Level of Flood Protection	100-year level + 2ft	100-year level + 1 ft	100 year level
Top Width	10 feet	10 Feet	10 Feet
Side Slopes	5' Horizontal to 1' Vertical	5' Horizontal to 1' Vertical	5' Horizontal to 1' Vertical
Length	524 feet	524 feet	524 feet
Additional Considerations and Materials	Clearing and Grubbing, Field Investigation	Clearing and Grubbing, Field Investigation	Clearing and Grubbing, Field Investigation

Flood Detention Scenarios

- Proposed Detention Facility Location

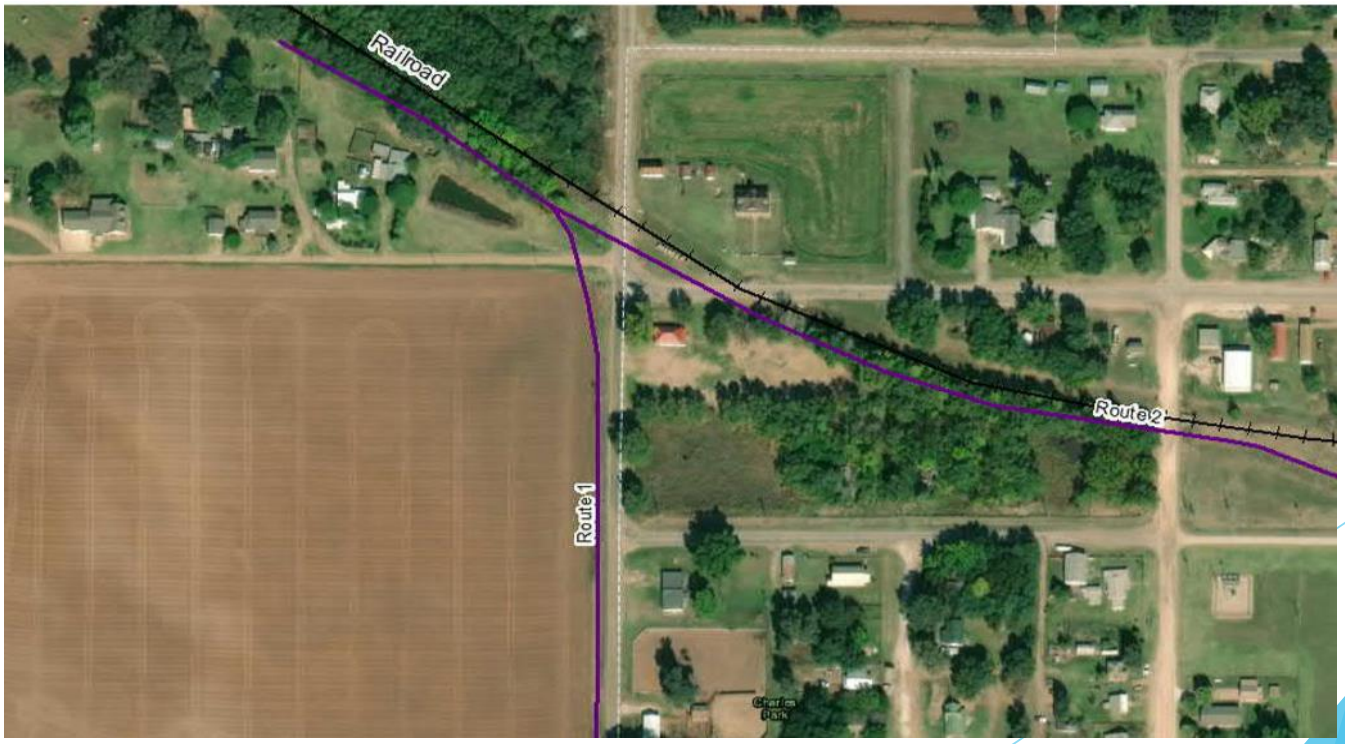
Flood Detention Scenarios

- Started with large detention facility to test feasibility of this option
- Proposed detention facility scenarios and characteristics

	Detention Facility 1	**Detention Facility 2**
Total Area	62,500 sq ft	140,340 sq ft
Depth	10 feet	5 - 15 feet
Side Slopes	5' Vertical to 1' Horizontal	5' Vertical to 1' Horizontal
Outlet Release Rate	3.0 cfs per site acre	3.0 cfs per site acre

Flood Channelization Scenarios

- Proposed channel routes
- Route 1: Divert flow south along 3rd Ave W back to Turkey Creek
- Route 2: Increase channel capacity along southside railroad embankment



Flood Channelization Scenarios

- Proposed channel scenarios and characteristics

	Channel 1	Channel 2	Channel 3	Channel 4
Type	Grass-Lined Open Channel	Grass-Lined Open Channel	Grass-Lined Open Channel	Grass-Lined Open Channel
Shape	Trapezoidal	Trapezoidal	Trapezoidal	Trapezoidal
Bottom Width	6 feet	5 feet	5 feet	6 feet
Depth	4 feet	3 feet	3 feet	4 feet
Side Slopes	3 ' Horizontal to 1' Vertical	3 ' Horizontal to 1' Vertical	3 ' Horizontal to 1' Vertical	3 ' Horizontal to 1' Vertical
Length	1,479 feet	2,414 feet	1,826 feet	1,826 feet
Route	Through Sun City along southside of railroad embankment.	South along westside of 3rd Ave W	South along westside of 3rd Ave W	South along westside of 3rd Ave W
Structures	Requires 2 Additional Concrete Box Culverts	Requires 1 Additional Concrete Box Culverts	No additional Structures	No additional Structures

Cost Estimates

- High-level estimates of construction costs
- 20% contingency costs included for uncertainty
- Further site investigation may call for changes to proposed structures and costs
- Does not include additional costs
  - Engineering & Design, Utility Impacts, Property Impacts, and permitting

Levee Scenarios

LEVEE 1			UNIT PRICE	EXTENSION
Mobilization	1	LS	$ 25,000	$ 25,000
Embankment (Contractor Furnished)	4003	CY	$ 25	$ 100,069
Compaction of Earthwork	4003	CY	$ 10	$ 40,028
Clearing & Grubbing	1	LS	$ 10,000	$ 10,000
Seeding & Mulching	1	acres	$ 5,000	$ 5,000
Riprap	400	SY	$ 100	$ 40,000
			Total	$ 220,097
			Contingency (20%)	$ 44,019
			Grand Total	**$ 264,117**

LEVEE 2			UNIT PRICE	EXTENSION
Mobilization	1	LS	$ 25,000	$ 25,000
Embankment (Contractor Furnished)	2838	CY	$ 25	$ 70,958
Compaction of Earthwork	2838	CY	$ 10	$ 28,383
Clearing & Grubbing	1	LS	$ 10,000	$ 10,000
Seeding & Mulching	1	acres	$ 5,000	$ 5,000
Riprap	400	SY	$ 100	$ 40,000
			Total	$ 179,342
			Contingency (20%)	$ 35,868
			Grand Total	**$ 215,210**

LEVEE 3			UNIT PRICE	EXTENSION
Mobilization	1	LS	$ 25,000	$ 25,000
Embankment (Contractor Furnished)	1868	CY	$ 25	$ 48,699
Compaction of Earthwork	1868	CY	$ 10	$ 18,680
Clearing & Grubbing	1	LS	$ 10,000	$ 10,000
Seeding & Mulching	1	acres	$ 5,000	$ 5,000
Riprap	600	SY	$ 100	$ 60,000
			Total	$ 165,379
			Contingency (20%)	$ 33,076
			Grand Total	**$ 198,454**

Detention Scenarios

DETENTION 1			**UNIT PRICE**	**EXTENSION**
Mobilization	1	LS	$ 25,000	$ 25,000
Common Excavation (Rural Small)	19,517	CY	$ 10	$ 195,174
Clearing & Grubbing	1	LS	$ 20,000	$ 20,000
Seeding & Mulching	1	acres	$ 5,000	$ 5,000
Outlet Structure	1	LS	$ 20,000	$ 20,000
			Total	$ 265,174
			Contingency (20%)	$ 53,035
			Grand Total	**$ 318,209**

DETENTION 2			**UNIT PRICE**	**EXTENSION**
Mobilization	1	LS	$ 25,000	$ 25,000
Common Excavation (Rural Small)	38,178	CY	$ 10	$ 381,784
Clearing & Grubbing	1	LS	$ 20,000	$ 20,000
Seeding & Mulching	1	acres	$ 5,000	$ 5,000
Outlet Structure	1	LS	$ 20,000	$ 20,000
			Total	$ 451,874
			Contingency (20%)	$ 90,357
			Grand Total	**$ 542,140**

Channel Scenarios

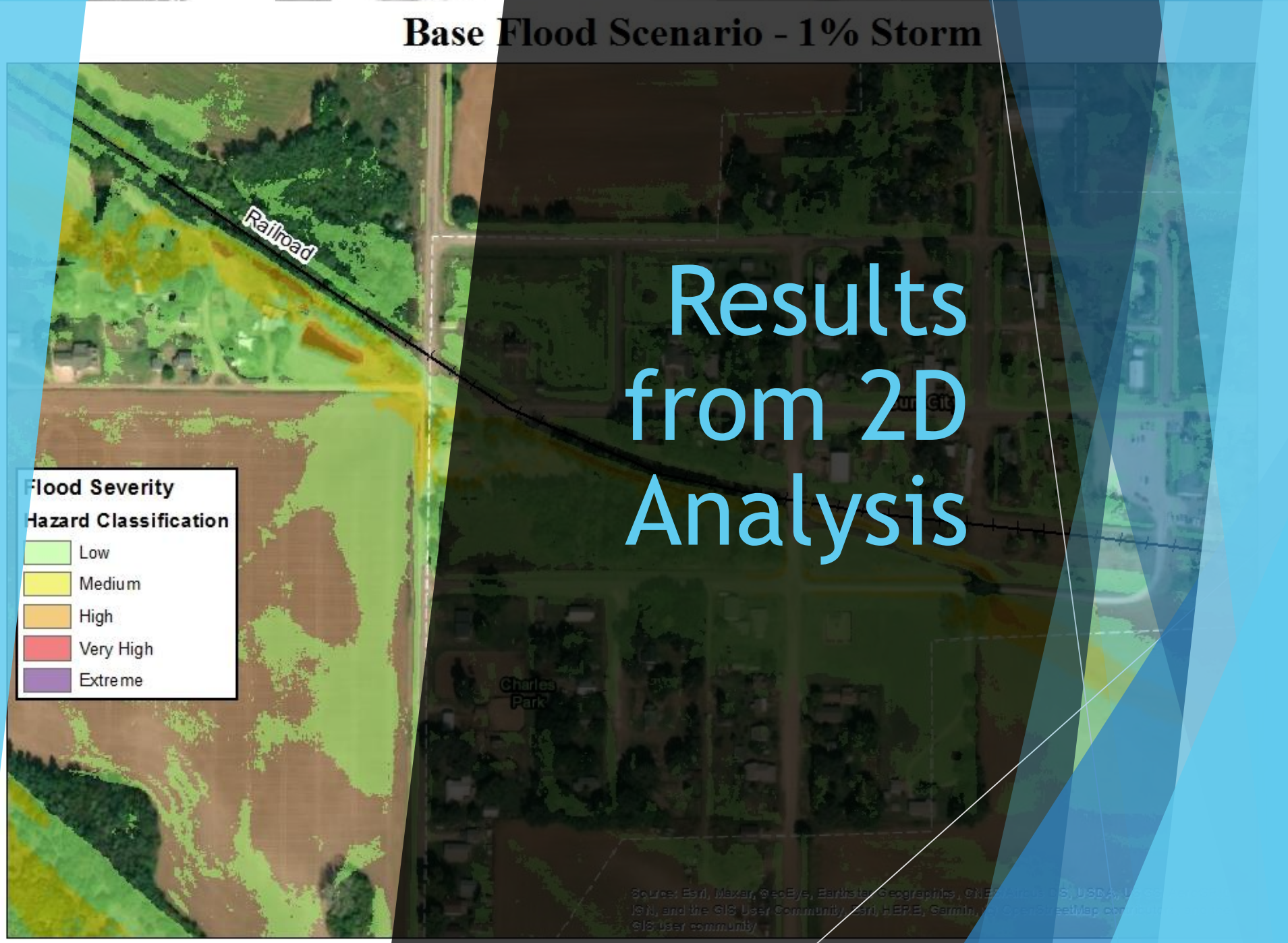
CHANNEL 1			UNIT PRICE	EXTENSION
Mobilization	1	LS	$15,000	$15,000
Common Excavation (Rural Small)	3944	CY	$15	$59,160
Clearing & Grubbing	1	LS	$40,000	$40,000
Seeding & Mulching	1.5	Acres	$5,000	$7,500
Box Culvert (RCB 10x4x50)	2	Ea	$75,000	$150,000
Riprap	150	SY	$100	$15,000
			Total	$286,660
			Contingency (20%)	$57,332
			Grand Total	**$343,992**

CHANNEL 2			UNIT PRICE	EXTENSION
Mobilization	1	LS	$15,000	$15,000
Common Excavation (Rural Small)	3755	CY	$15	$56,327
Clearing & Grubbing	1	LS	$40,000	$40,000
Seeding & Mulching	1.5	Acres	$5,000	$7,500
Box Culvert (RCB 10x4x50)	1	Ea	$75,000	$75,000
Riprap	75	SY	$100	$7,500
			Total	$201,327
			Contingency (20%)	$40,265
			Grand Total	**$241,592**

Channel Scenarios (cont'd)

CHANNEL 3			UNIT PRICE	EXTENSION
Mobilization	1	LS	$15,000	$15,000
Common Excavation (Rural Small)	2840	CY	$15	$42,607
Clearing & Grubbing	1	LS	$30,000	$30,000
Seeding & Mulching	1	acres	$5,000	$5,000
Riprap	0	SY	$100	$-
			Total	$92,607
			Contingency (20%)	$18,521
			Grand Total	**$111,128**

CHANNEL 4			UNIT PRICE	EXTENSION
Mobilization	1	LS	$15,000	$15,000
Common Excavation (Rural Small)	4869	CY	$15	$73,040
Clearing & Grubbing	1	LS	$40,000	$40,000
Seeding & Mulching	1.5	acres	$5,000	$7,500
Riprap	0	SY	$100	$-
			Total	$135,540
			Contingency (20%)	$27,108
			Grand Total	**$162,648**


Base Flood Scenario - 1% Storm
Railroad
Flood Severity
Hazard Classification
Low
Medium
High
Very High
Extreme
Charles Park
Results from 2D Analysis

Results

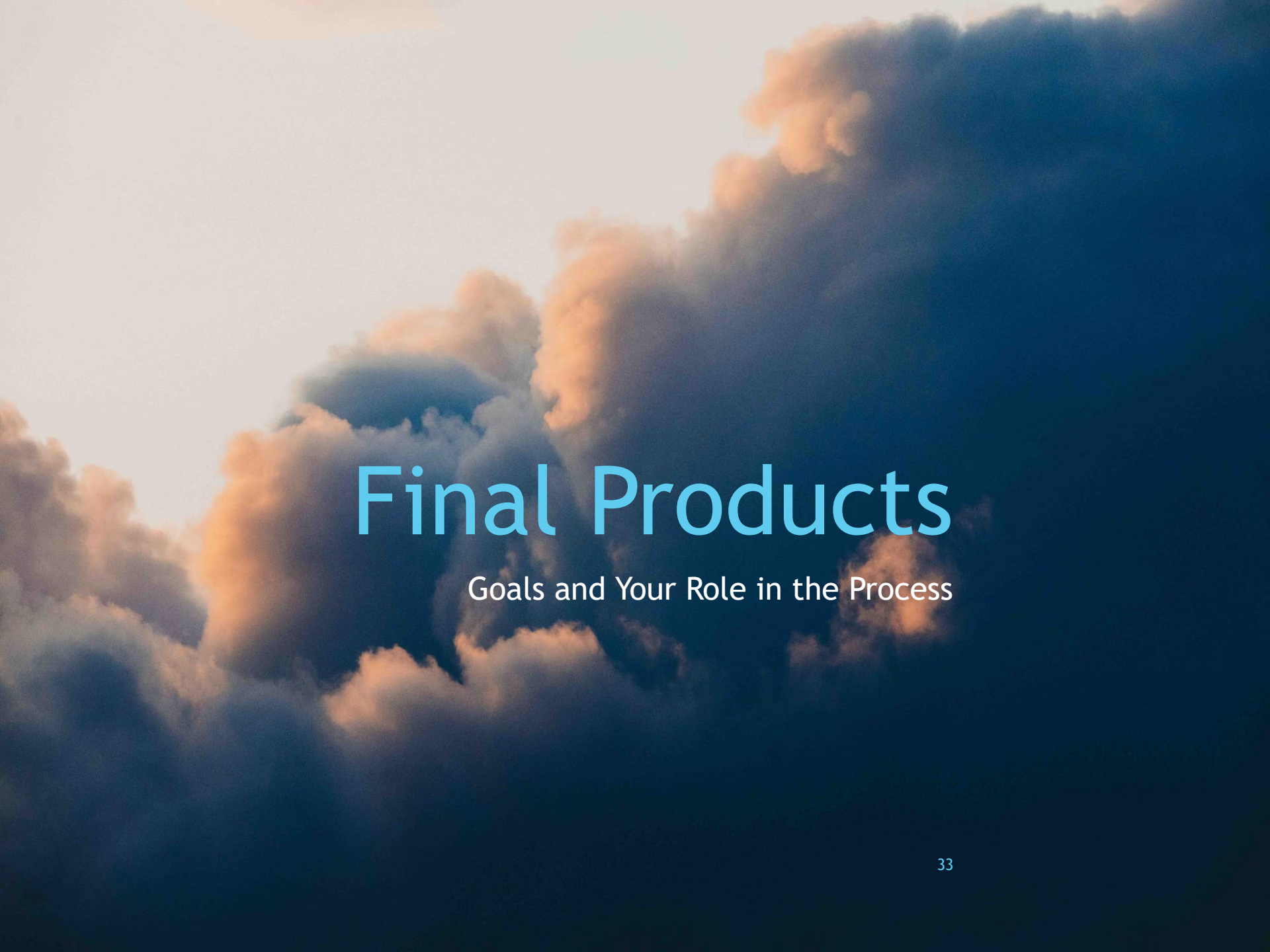
- Depth, Water Surface Elevation, and Flood Severity products to be provided for each scenario
- Use (Depth x Velocity) to quantify flood hazard
- FEMA Flood Severity Classifications

Flood Severity Category	Depth * Velocity Range (ft^2/sec)
Low	< 2.2
Medium	2.2-5.4
High	5.4 -16.1
Very High	16.1-26.9
Extreme	> 26.9

Map Viewing & Discussion

Cost-Benefit Analysis

Flood Mitigation Scenarios	% of Inundation Area Reduction	% of Flood Hazard Reduction	Estimated Construction Cost	Cost per % of Hazard Reduction
Levee 1	38.4%	89.3%	$264,117.00	$2,956.10
Levee 2	38.4%	89.3%	$215,210.00	$2,408.71
Levee 3	38.4%	89.3%	$198,454.00	$2,221.17
Detention 1	11.6%	44.6%	$318,209.00	$7,141.34
Detention 2	12.5%	45.2%	$542,140.00	$11,987.71
Channel 1	9.7%	32.0%	$334,992.00	$10,474.65
Channel 2	20.0%	29.4%	$241,592.00	$8,211.61
Channel 3	16.7%	32.4%	$111,128.00	$3,432.96
Channel 4	15.7%	34.3%	$162,648.00	$4,747.46



Final Products

Goals and Your Role in the Process

Final Products

- 2D HEC-RAS models for each flood mitigation scenario.
- Results of the Water Surface Elevation, Depth, and Flood Severity of each flood scenario
- Mapping exhibit for each flood scenario
- Report outlining engineering methods, results, and estimate design/build costs
- Web Map

Path Forward

- Utilize engineering study to determine the best plan of action for Sun City
- Apply for Grants

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